# SYNOPSIS

# Quasiperiodicity chaos and weak turbulence in plasmas

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The study of different waves in plasmas has recieved a great amount of attention due to its rich theory and wide range of applications in space and experimental plasma environments [1]-[7], such as cometary tails, planetary rings, asteroid zones, interstellar medium, Earth's ionosphere, magnetosphere etc. Recently, researchers have paid more attention towards the study of bifurcation, quasiperiodicity and chaotic behaviour of different waves in plasmas [8]-[12]. Samanta et al. [8] studied the bifurcations of nonlinear propagation of ion acoustic waves (IAWs) in a magnetized plasma whose constituents are cold ions and kappa distributed electron using a two component plasma model in the framework of Zakharov-Kuznetsov equation. Using the bifurcation theory of planar dynamical systems they have shown, the existence of solitary wave solutions and periodic travelling wave solutions. Sahu et al. [10] investigated the ion acoustic solitary waves in an unmagnetized electron-ion quantum plasmas. They showed that ion temperature plays a critical role in the dynamics of quantum electron ion plasma, especially for arbitrary amplitude nonlinear waves. They also obesrved that in the small amplitude region Korteweg-de Vries equation describes the solitonic nature of the waves. However, for arbitrary amplitude waves, in the fully nonlinear regime, the system exhibits possible existence of quasi-periodic behavior for small values of ion temperature. Saha et al. [11] preseanted the qualitative structures of electron-acoustic waves in an unmagnetized plasma. Considering an external periodic perturbation, they have shown that the non-extensive parameter ($q$), the ratio between hot electron and cold electron number density at equilibrium ($\alpha$) and speed of the traveling wave (v) play crucial roles for electron-acoustic solitary, periodic and chaotic structures.

Multi-soliton solution of Korteweg de Vries (KdV) equation and the different kind of nonlinear interactions between them is a topic of interest among the researchers [13]-[20]. It is well known that in the theory of turbulence the four moments (mean, variance, skewness and kurtosis), characterises the statistical properties of the wave field, which are obtaied from the measurements [21]-[24]. Pelinovsky et al. studied the interaction of two solitons within the framework of the Korteweg-de Vries equation as an elementary act of soliton turbulence [25]-[26]. They showed that the interactions lead to a decrease in the third and fourth moments of the wave field, whereas the first and second moments, which are invariants of the Korteweg-de Vries equation, remains constant.

However, there is no study on the effect of dust ion collision on the quasiperiodic and chaotic features of the non linear waves in collisional dusty plasmas. Also, there is no work on chaotic behaviour of positron acoustic waves in magnetized and unmagnetized plasma in presence of an externally applied periodic force. Furthermore, there is no study on weak turbulence in different kind of plasma models.

So, based on the literature survey, the following problem may be proposed in my Ph.D programme

- The dynamical behaviour of positron acoustic waves in unmagnetized electron-positron-ion (e-p-i) plasma models.
- The dynamical behaviour of positron acoustic waves in magnetized electron-positron-ion (e-p-i) plasma models.
- The analytical solution of different kind of non-linear evolution equations in presence of periodic force term.
- The effect of different plasma parameters on multi-soliton interaction and weak turbulence within the framework of KdV equation.

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